Marking Period	Unit Title	Recommended Instructional Days
2	Polynomial functions	14-15 days

Domain:		
NJSLS Strand: **N-CN.7** Solve quadratic equations with real coefficients that have complex solutions, **N-CN.8** (+) Extend polynomial identities to the complex numbers. *For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.* **N-CN..9** (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. **A-SSE.**2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.* **A-APR.1**Understand that polynomials form a system analogous to the integers,	*Progress Indicator:* *Tests ● Quizzes ● Practice problems for homework ● Online textbook ● Worksheets ● IXL ● Leveled assessments*	**Recommended Activities, Investigations, Interdisciplinary Connections, and/or Student Experiences to Explore NJSLS-CLKS within Unit** **Essential Question/s:** **What can the rule for a polynomial function reveal about its graph, and what can the graphs of polynomial functions reveal about the solutions of polynomial equations?** **Activity Description**: Graphing Polynomial functions Adding, subtracting and multiplying polynomials Dividing Polynomials Zeros of Polynomials functions Theorems about roots of Polynomial equations **Interdisciplinary Connections:** **TOPIC 2 PROJECT enVision STEM** **Content: Design a stadium** **NJSLS#: HS.ETS1-2, HS.ETS1-4, HS-LS2-1** **Example Tasks:** **At the end of each topic please review the Assessment Practice and Performance Tasks questions.**

namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
A-APR.2 Know and apply the Remainder Theorem: For a polynomial p(x) and a number *a*, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x-a) is a factor or p(x).
A-APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
A-APR..4 Prove polynomial identities and use them to describe numerical relationships. *For example, the difference of two squares; the sum and difference of two cubes; the polynomial identity* $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*
A-APR..5 (+) Know and apply the Binomial Theorem

Mixed Review Available Online

☑ **ASSESSMENT PRACTICE**

30. Are polynomials open or closed under each operation? Classify each operation as *open* or *closed*.

a. addition

b. subtraction

c. multiplication

d. division

for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.
 A-APR.6. Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.
A-CED.1 Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*
A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph

32. Performance Task Consider the polynomial functions $P(x) = x^2 - 4$ and $R(x) = -x^2 - 2x$.

Part A Write and simplify a polynomial function $T(x)$ that is the product of P and R.

Part B Copy and complete the table of values for all three functions.

x	P(x)	R(x)	T(x)
−3			
−2			
−1			
0			
1			
2			
3			

Part C Graph the functions on the same coordinate grid.

Part D How do the zeros of T relate to the zeros of P and R?

Part E Explain how you can identify the intervals in which T is positive by analyzing the R and P.

equations on coordinate axes with labels and scales.

A-CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

A-REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A-REI. Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x)

Mixed Review Available Online

✓ **ASSESSMENT PRACTICE**

28. Complete each statement so it means the same as 4 is a *zero of the function*.

The graph of the function crosses the

_____ at 4. _____ is a factor of the polynomial.

t

30. Performance Task Venetta opened several deli sandwich franchises in 2000. The profit P (in hundreds of dollars) of the franchises in t years (since the franchises opened) can be modeled by the function $P(t) = t^3 + t^2 - 6t$.

Part A Sketch a graph of the function.

Part B Based on the model, during what years did Venetta not make a profit?

Part C If the model is appropriate, predict the amount of profit Venetta will receive from her franchises in 2020.

Spot Light on: Climate Change
Global warming due to fossil fuel emissions, is believed to be one of the causes for climate change. Therefore, there is an increased interest in the use of renewable and cleaner sources of energy. This lesson plan will help improve students' literacy in clean energy sources while enabling them to practice Formula Substitution. It includes resources to teach your students about the components of formulas, and substitution in a formula using the energy equation for wind turbines, to enable them to understand the energy available from wind.

= g(x); find solutions approximately; e.g., using technology to graph functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*

F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given in a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*

F-IF.7 Graph functions expressed symbolically and show key features if the graph, by hand in simple

cases and using technology for more complicated cases. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, showing end behavior. **F-BF.1** Write a function that describes a relationship between two quantities. **F-IF.3** Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x +k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*		
Mathematics Practices		
1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reason of others. 4. Model with mathematics.		

5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Social and Emotional Learning: *Competencies*	Social and Emotional Learning: *Sub-Competencies*
Self- awareness Social Awareness Self- Management Relationship Skills Responsible Decision-Making	Recognizing the importance of self-confidence in handling daily tasks and challenges. Demonstrate an awareness of the expectations for social interactions in a variety of ways. Demonstrate an understanding of the need for mutual respect when viewpoints differ. Recognize the skills needed to establish and achieve personal and educational goals. Utilize positive communication and social skills to interact effectively with others. Develop, implement, and model effective problem solving and critical thinking skills.

Assessments (Formative) *To show evidence of meeting the standard/s, students will successfully engage within:*	Assessments (Summative) *To show evidence of meeting the standard/s, students will successfully complete:*
Formative Assessments: ● Entry and Exit Slips ● Quizzes ● Self Assessments	**Benchmarks:** ● Chapter Tests ● Projects **Summative Assessments:** ● District Assessments

		● Midterms ● Standardized Tests	

Differentiated Student Access to Content: **Teaching and Learning *Resources/Materials***			
Core **Resources**	**Alternate** **Core Resources** ***IEP/504/At-Risk/ESL***	**ELL** **Core Resources**	**Gifted & Talented** **Core Resources**
● Textbooks websites ● Achieve the core ● Khan Academy ● Desmos	● Skill building worksheets ● Math Manipulatives	● Dictionary for native languages ● Videos in their native language.	● Leveled Assessments ● Enrichment worksheets

Supplemental Resources

Technology:
- **Chromebooks, Graphing Calculators, Online math manipulatives**

Other:
- **Zoom and Google Meets, Google Classroom, Interactive Textbooks**

Differentiated Student Access to Content: **Recommended *Strategies & Techniques***			
Core **Resources**	**Alternate** **Core Resources** ***IEP/504/At-Risk/ESL***	**ELL Core** **Resources**	**Gifted & Talented** **Core**
● **Deliver instruction utilizing varied learning styles including audio, visual, and tactile/kinesthetic, provide individual instruction as needed, modify assessments and/or rubrics, repeat**	● **Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations, additional examples, modeling, etc.), modify test content and/or format, allow students to retake test for additional credit, provide additional times and preferential**	● **Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary, supplemental materials including use of an online bilingual dictionary, and modified assessment and/or rubric.**	● **Create an enhanced set of introductory activities, integrate active teaching/learning opportunities, incorporate authentic components, propose interest-based extension activities, and connect student to related**

	seating as needed, review, restate and repeat directions, provide study guides, and/or break assignments into segments of shorter tasks.		

	Disciplinary Concept: Creativity and Innovation	
NJSLS CAREER READINESS, LIFE LITERACIES & KEY SKILLS	*Core Ideas:*	Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences.
	Performance Expectation/s:	99.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
	Career Readiness, Life Literacies, & Key Skills Practices	
	Act as a responsible and contributing community member and employee. Attend to financial well-being. Consider the environmental, social and economic impacts of decisions. Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership and effective management. Plan education and career paths aligned to personal goals. Use technology to enhance productivity, increase collaboration and communicate effectively. Work productively in teams while using cultural/global competence.	

New Jersey Legislative Statutes and Administrative Code
(place an "X" before each law/statute if/when present within the curriculum map)

| | Amistad Law: *N.J.S.A. 18A 52:16A-88* | | Holocaust Law: *N.J.S.A. 18A:35-28* | | LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35* | | Diversity & Inclusion: *N.J.S.A. 18A:35-4.36a* | X | Standards in Action: *Climate Change* |